

APPLICATION FOR UNITED STATES LETTERS PATENT**UTILITY APPLICATION**

FOR

Interactive Try-on Platform for Eyeglasses**Inventors:**

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Express Mail Label # EK628885569US ; Date of Deposit: March 29, 2001

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Signed: 

Joe Zheng

Interactive Try-on Platform for Eyeglasses

Docket No.: 888124-10

CROSS-REFERENCE TO RELATED APPLICATION

5 This application claims the benefits of the provisional application, No. 60/266,799, entitled "Interactive 3D Models for Online Commerce", filed 02/06/2001, which is hereby incorporated by reference for all purposes.

BACKGROUND OF THE INVENTION

10 Field of the Invention

 The present invention generally relates to the area of electronic commerce and more particularly relates to an interactive test or try-on platform in which a user can try on eyeglasses of different styles on a 3D face model provided by the user, wherein
15 the 3D face model is preferably generated from the user so that the user can electronically and interactively try on a selected pair of glasses.

Description of the Related Art

 The Internet is a data communication network of
20 interconnected computers and computer networks around the world and is rapidly evolving to the point where it combines elements of telecommunications, computing, broadcasting, publishing, commerce, and information services into a revolutionary business

infrastructure. The economy on the Internet is growing in every aspect of life, a wide range of businesses including stock trading, commodities, products, retails and services ordering are all via the Internet.

5 The growth of Internet-based electronic commerce, however, is experiencing some obstacles when coming to certain types of services and goods. For example, it would be very difficult for a business to promote wearable goods online, such as footwear, glasses and accessories. When buying expensive leather shoes, very few consumers would order a pair over the Internet. One of the reasons is that everyone has developed his/her own shaped feet through years of walking habits. Generically sized shoes could hardly fit comfortably on everyone's foot. On the other hand, the markets for the shoe manufacturers and businesses are limited to certain geographic areas. Eyeglasses are another example. Unless it is a pair of generic sunglasses, very few consumers would order personalized glasses, such as near-sighted glasses, over the Internet. Similar reasons are applied because a consumer likes to try on a pair of chosen glasses and see from a mirror how he/she looks with the chosen pair, hence the market for eyeglasses is primarily limited to local retailing. Indeed, there are many other consumer products and industrial goods or services that are being limited to local markets because the current Internet-based commerce platform lacks "try on" experiences. There is, therefore, a need for a mechanism that a user or buyer could "try on" or test a

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selected item or service over the Internet before a commitment to the selected item can be made.

SUMMARY OF THE INVENTION

5 The present invention relates to techniques and systems that provide interactions between a 3D representation of an item being selected and a fully-textured 3D model of an object. The present invention can be used advantageously for electronic commerce over the Internet, wherein a business can provide a 3D representation of an item for a user to virtually try or test on an
10 object. As a result, a user can visually perceive subsequent effects of the item on the object.

According to one embodiment, an interactive presentation or platform including a 3D representation of an item and a 3D model of an object is provided. The item is selected by a user for the
15 object. In other words, the item may be worn by, attached to or joined with the object preferred by the user. Within the interactive presentation, the user can try or test the item on the object by, perhaps, adjusting spatially or manipulating the item in a 3D space. Further the interactive platform provides a view of the object with
20 the item on from any selected perspective.

According to another embodiment, an interactive platform designed for 3D representations of eyeglasses is provided. The platform allows an import of a 3D face model of a user (e.g. a

potential buyer). Within the interactive platform, the user can select a pair of glasses expressed in a 3D representation and try or test the glasses on the provided 3D face model. In particular, a default position of the glasses is provided with respect to the 3D face model. At "OFF" position, a pair of glasses is placed in front of but off the face model. At "ON" position, the glasses is placed onto the face model. As a result, the user can feel the process in which the glasses is being tried on the 3D face. Further the interactive platform allows the user to adjust the glasses spatially with respect to the face model as well as to visualize the combined 3D models (e.g. the glasses on the face model) from any selected perspective.

The present invention may be implemented as a method, an apparatus, a system or a computer product. Different implementation may yield one or more of the following advantages and benefits. One of them is the interactive presentation mechanism that permits a user to try or test visually or graphically an item selected for a preferred object with respect to the object itself. The feature is believed to be significantly different from some existing web sites that offer "try-on" experiences on a generic object. The present invention offers the user a mechanism to supply a 3D model of the real and specified object. For example, when the item is a wearable product and the object is the user himself/herself, the user can perceive how he/she may look like with the wearable product. Another advantage or benefit provided by the present invention is the marketing opportunity of certain type

of goods or services that would otherwise be limited to local retailing. With the present invention, these goods or services can now be offered online so remote users can "feel" these goods or services over the Internet.

5 Other advantages, objects and features of the present invention, together with the foregoing, are attained in the exercise of the invention in the following description and resulting in the embodiment illustrated in the accompanying drawings.

10 BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying
15 drawings where:

Figure 1 shows a system configuration in which the present invention may be practiced;

Figure 2A shows a functional diagram of a provider's server according to one embodiment of the present invention;

20 **Figure 2B** shows essential functions of a user interactive module in a provider's server according to one embodiment of the present invention;

Figure 3A and 3B show respectively two possible settings to generate a 3D representation of an item or a 3D model of an object;

Figure 4 is a process flowchart of operations on a server device that offers items over a data network;

5 **Figure 5A and 5B** show respectively two processes of operations on a client device according to one embodiment to the present invention; and

10 **Figures 6A to 6E** show, as an example, a sequence of interactive presentations, each including a selected eyewear and a human face according to one embodiment to the present invention;

15 **Figure 7** shows an example of determining characteristics of a 3D face model, the characteristics including coordinates of a nose tip and pupils of the face model; and

Figure 8 shows a process flowchart of glasses fitting operations according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 The invention relates to techniques, systems or platforms that provide interactions between a 3D representation of an item being selected and a fully-textured 3D model of an object for electronic commerce over the Internet. An item or items herein

mean that products or services are offered by a business online so that potential users or buyers may consider acquiring or using the products or services. The examples of such items may include, but not be limited to, wearable items for consumer, industrial parts for devices or services or any physical thing that may require a fitting trial on the object before a user or buyer may consider acquiring or using the item(s). An object herein means a potential receiver of the selected item(s). Examples of such object may include, but not be limited to, a user himself/herself to wear the selected item and a device to install the selected item.

In particular, the present invention is implemented to facilitate electronic commerce of eyeglasses. A user is provided with an interactive try-on platform that permits an import of a 3D face model, preferably, of a potential wearer of a pair of eyeglasses. By virtue of the present invention, the interactive platform allows the user to select a pair of glasses, try the selected glasses on the face model, adjust the glasses spatially and view the face model with the glasses on from any chosen perspective.

The present invention can be advantageously used in electronic commerce over a data network. With the employment of the present invention, a business can now offer through the data network many other items that would otherwise be limited to local retailing. Not only does the present invention now help a business reach more markets without physical boundaries but also provide

remarkable convenience to buyers who could now try on different selections without leaving their home or office.

The detailed description of the invention is presented largely in terms of procedures, steps, logic blocks, processing, and other symbolic representations that directly or indirectly resemble the operations of data processing devices coupled to networks. These process descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art. Numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Reference herein to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or

diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Referring now to the drawings, in which like numerals refer to like parts throughout the several views. **Figure 1** shows a system configuration **100** in which the present invention may be practiced. As used herein, a service or product provider, or simply referred to as a provider represents one of numerous businesses, entities, merchants or retailers that offer various products, applications and services online. Examples of such a provider may include www.amazon.com that offers items from books to consumer electronics, www.ebay.com that offers an auction platform where bidders and sellers can interact with each other.

As shown in the figure a provider **102**, typically through a server computer, is coupled to a data network **104** that may be the Internet or a network of private and/or public networks. To facilitate online transactions between the provider and a user (e.g. a consumer), a third party entity **106**, also through a server computer, may be coupled to network **104**. Third party entity **106** may represent a financial or authorized institution, such as a bank, a credit card authority or an agent, that provides a mechanism for the provider to verify various information submitted by the buyer for a transaction or to electronically proof anything required by the provider from the user.

As used herein, a transaction means an electronic agreement mutually agreed between two entities. For example, a transaction occurs when a provider accepts an order of certain items from a user or buyer. Likewise a transaction is deemed to occur when pertinent data/information entered/provided by the buyer is released to the provider after the buyer has tried on and decided to acquire his/her selections. In general a "try on" or "test" means a process in which the user tests an item in accordance with a set of criteria determined by the user. For example, a buyer is buying a pair of glasses. Before a transaction happens, the buyer wants to make sure how he/she may look like after he/she wears the glasses on. Hence a "try on" or a test with the object happens.

For illustration purpose, a user **108** communicates with provider **102** through a computing device, referred to as a client device, that may include, but not be limited to, a personal computer, a palm-size computing device, a wireless mobile device and a personal data assistant (PDA), having a display screen and capable of two-way data communications with data network **104** for ordering and browsing electronically products or services offered by an online business.

To facilitate the description of the present invention, it is defined herein a display screen or simply a screen is the physical display apparatus in a device, such as a 15 inch CRT or LCD monitor, commonly seen with a personal computer. Likewise, a

screen display or simply display is an image presented on the display screen. For example, a file that constitutes a display or part of the display may be an HTML, a VRML file, or a plurality of data representing a 3D representation for an item or a 3D model of an object. A display is displayed on a screen when the file is read or executed by an application or executed by a browser.

For completeness, a service provider or a business unit **110**, also through a respective server computer, is coupled between network **108** and sub-network **112**. Typically, sub-network **112** that may be part of network **108** or a local area network (LAN) belonging to a locality serves its own community comprising a number of client devices **114** (i.e. **114-1** to **114-n**), each representing an access to the service provider from a user or a consumer. In general, each of client devices **114** may be a personal computer, a palm-size computing device, a mobile device or a cable control box facilitating Internet services via a cable. Via service provider **110** that may be an Internet service provider, a wireless carrier, a cable service provider, or any data service provider, each of client devices **114** can communicate with provider **102** for ordering, viewing and browsing electronically a product or a certain type of services offered by provider **102**.

Referring now to **Figure 2A**, there is shown a functional block diagram of a provider's server **200** according to one embodiment of the present invention. Server device **200** may be a

server computer or a workstation hosted by provider **102** of **Figure 1** to offer products for sales or services online. In one embodiment, server device **200** is offered from Sun Microsystems of Mountain View, California and loaded with a server module **202** that may be configured to include an online transaction module **204**, an item list module **206** and an user interactive module **208**. Online transaction module **204** may be any one of the commercially available or customized applications that facilitate transactions with a client device over a network. One exemplary online transaction module **204** may be from Oracle Corporation in Redwood, California and commonly used in many of the frequently visited web sites.

The functions of user interactive module **208** is illustrated in **Figure 2B** according to one embodiment of the present invention. User interactive module **208** receives a specification from a user, for example, a hat with size A, style B and color C. Upon receiving the specification, user interactive module **208** inputs the specification to a database **220** that maintains a list of items for offering over the network. Generally, the items maintained in database **220** has respective specifications and may be categorized in a way that depends on what business the items fit into.

According to one embodiment of the present invention, at least one of the items is associated with a 3D representation or a 3D model, which means the item is represented graphically in 3-

dimensions. The 3D representation of the item is preferably generated in advance by one of the settings provided below or through a 3D modeling service such as Geometrix, Inc. (see www.geometrix.com). The 3D representation may be expressed by one or more files in one of the 3D object formats such as VRML (Virtual Reality Modeling Language) and RWX (MEME Shape file). In one implementation, the 3D representation is expressed as a Cult3D object file. Cult3D object file is supported by Cult3D Viewer or Cult3D Exporter offered by Cult3D Inc. (see www.cycore.com). After a user selects an item, the 3D representation thereof is retrieved from the database and transported to an interactive environment (i.e. a presentation) as will be further described below.

In database **220**, detailed information of the item matched by the specification is located and retrieved. It is assumed that the specified item is associated with a 3D representation **224** as shown in **Figure 2B**. The detailed information now includes the 3D representation in addition to, perhaps, price, manufacturer, date or other related information about the selected item. In one embodiment, 3D representation **224** can be transported over a network and subsequently displayed along with other related information on a client device used by the user, wherein the client device is executing an application or browser to view the 3D representation.

To facilitate the description of the present invention, a 3D model of an item to be tried on an object is referred to as a 3D representation. In operation, user interactive module **208** will require a 3D model of an object that is to receive the selected item.

5 According to one implementation, the 3D model of the object is provided by the user from a known location (e.g. from a local hard disk). In that case, the 3D model of the object is pre-generated. In another implementation, the 3D model of the object is generated on demand.

10 **Figure 3A** illustrates an exemplary setting **300** that may be used to generate a 3D model of the object or one or more of the items for selection. An item **302** to be modeled electronically may be a combination of one or more 3D objects such as toys, products or devices. Item **302** is placed on a turntable **304** that is preferably controlled by a stepper motor (not shown). The stepper motor

15 operates under the control of a computer system **306** to rotate turntable **304** so that object **302**, when being turned around, can be viewed and imaged by an imaging system **308**. Subsequently imaging system **308** produces a surrounding imagery comprising a

20 number of side view images, each taken at a predetermined relative position of object **302** with respect to imaging system **308**. The images are then processed in computer system **306** that is loaded with a 3D modeling application. The detail description of the setting **300** as well as the 3D modeling application is provided in

25 US App. No.: 09/357,528, entitled "Method and System for

Generating Fully-Textured 3D Models" by Zwern et al, which is hereby incorporated by reference in its entirety.

Figure 3B illustrates another exemplary setting **330** that may be used efficiently to generate a 3D model of the object offline or on demand. A camera system **320** is coupled to a client device **322** that may be coupled to the network. In particular, the client device is loaded with a 3D modeling application that generates a 3D model of an object. One exemplary 3D modeling application called FaceCapture from Geometrix, Inc. (see www.geometrix.com) in San Jose, California, can be executed in client device **322** and generates a 3D model based on one or two images of the object. As shown in the figure, a user **324** who may be an object can generate a 3D model of his/her face using the camera system **320** and the 3D modeling application. As a result, a fully-textured 3D model of the face is generated, an example thereof will be shown below. As used in some embodiments, setting **330** may be used to generate 3D models of other objects.

It is now evident to those skilled in that art that the setting in **Figures 3A or 3B** can be used to generate a 3D representation of an item as well as the object. To facilitate the description of the present invention, two words "3D representation" and "3D model" are used to distinguish 3D information presented from two ends (i.e. the server and the client). In reality, they can be interchangeably used and may be represented in the same format

or two compatible formats. Also it should be noted that the setting in **Figures 3A** and **3B** are for examples only. There may be other ways or tools that can be used to generate a fully-textured 3D model of an object that includes a human being or an article. What is important herein is the use of such 3D models to support electronic commerce over a network. In addition, as will be further described below, it is one of the features in the present invention that an interactive environment is provided that a user can try, test, or manipulate virtually and graphically the 3D representation of a selected item on the 3D model of an object provided by the user. An integrated representation of the 3D model with the 3D representation on can be viewed or browsed from any perspective in a 3D space. In some sense, the user could perceive what might be subsequent effects when the item and the object are actually attached, joined, connected or affiliated.

Figure 4 is a process flowchart **400** of operations, according to one embodiment of the present invention, on a server device that offers items or services over a data network and shall be understood in conjunction with the preceding figures. The server device may correspond to server device **104** of **Figure 1**. In a preferable embodiment, process **400** is implemented as a server module **202** of **Figure 2A**. At **402**, process **400** awaits a request from the network. When a request comes, process **400** proceeds. In one embodiment, the request is an HTTP request and the network is the Internet. The request is typically sent from a client

device associated with a user. It is assumed that the user has made a selection after browsing a category or a list of items being offered online by the server device. In addition to a specification of the selected item, the request includes an IP address identifying the client device or an identifier identifying the user. Upon receiving the request, the specification is extracted and process **400** goes to, perhaps, a database to look up for the selected item.

At **404**, a search response to the request comes back and indicates if the selected item has an associated 3D representation. It is noted that it is not necessary for the server device or a business to offer items each of which must have a 3D representation for a user to test with an object. When the search response shows that the selected item has no associated 3D representation thereof, process **400** goes on to **406** that may simply display a picture of the selected item. Although a picture is not necessary for a selected item, it is generally preferable to show to the user what the selected item may look. At **416**, process **400** needs to know if the user is satisfied with the selected item or pleased with the picture along with various product related information. If the response from the user is positive, process **400** moves along, for example, to enter a transaction with the user or other mutually agreed arrangement. If the user is not satisfied with the selected item, process **400** goes back to **402** to await another selection (i.e. a new request).

Referring back to **404**, the search response comes back and indicates that the selected item has an associated 3D representation. Process **400** moves on to **407** to see if there is a 3D model of an object available for trying on the selected item. The 3D model may be locally available (e.g. pre-generated or generated on demand) in the computing device that the user is using or remotely available in the server device or another computing device coupled to the network.

Depending on an exact implementation, the 3D model of an object may be located in a known location. For example, the user is looking for a fancy spoiler for his car. A 3D model of the car may have been generated using the setting in **Figure 3A**. The 3D model is then stored in a hard disk or another computer accessible by the user when the 3D model is needed. The 3D model can now be loaded to test with the spoiler (i.e. the 3D representation thereof). The purpose is to let the user see how the car may look with a selected spoiler before a transaction takes place. In another application that will be further described below, a user is looking for a pair of glasses. After the glasses is selected, process **400** now checks if there is a 3D model of the face of someone (e.g. the user). The 3D model could be generated on demand using the setting illustrated in **Figure 3B** or loaded from a known location.

At **407**, if process **400** determines that there is a 3D model available for trying on the selected item, process moves to **412**. On

the other hand, when process **400** determines that there is no 3D model available for trying on the selected item, process **400** moves to **408** to request the import of the 3D model.

At **410**, process **400** awaits the availability of the 3D model.

5 According to an option in one embodiment, process **400** checks if the format of the 3D model is supported or not at **410**. Once the 3D model is successfully loaded, an interactive presentation is provided at **412** and subsequently displayed on the client device. There are at least two possible implementations for **412**. The first
10 one is to upload the 3D model to the server device in which the server module performs an integration process to combine the 3D representation of the item with the uploaded 3D model of the object and then present them in an interactive environment for the user to continue. The second one is to have the interactive environment
15 downloaded to the client device wherein the interactive environment has a placeholder for the 3D model. Once the 3D model is supplied, the interactive environment integrates the 3D model with the 3D representation. The user can now interact with the interactive environment. Regardless of the exact
20 implementation, the interactive environment shows a combined or integrated view of the 3D representation and the 3D model.

At **414**, the user is allowed to move either one of the 3D representation and the 3D model with respect to the other in the interactive environment. In one application, the user moves the 3D

representation or 3D model spatially with respect to the 3D model or the 3D representation, respectively. In another application in which a customized part is required for the object, the interactive environment permits the user to modify the shape of the selected item for, perhaps, best fitting into the object. The exact manipulation of the 3D representation with respect to the 3D model does not affect the operations of the present invention. In any case, the manipulated, joined or integrated representation of the 3D representation and the 3D model can be viewed or browsed from any perspective so that the user could have a complete visual coverage of the subsequent effects or fitting of the item with the object.

Similar at **416**, process **400** needs to know if the user is satisfied with the selected item or pleased with the complete visual coverage along possibly with other information. If the response from the user is positive, process **400** moves along, for example, to enter a transaction with the user or other mutually agreed arrangement. If the user is not satisfied with the selected item, process **400** goes back to **402** to await another selection (i.e. a new request).

Figure 5A is a process flowchart **500** of operations, according to one embodiment of the present invention, on a client device used by a user to test or try on a selected item offered over a network by a server device and shall be understood in

conjunction with the preceding figures. The client device may correspond to any of **108** or **114** in **Figure 1**. At **502**, process **500** needs to ensure that a data link has been established with the server device over the network. According to one embodiment, the client device executes a browser application that provides an HTTP link over the Internet. Once the web site hosted by the server device is connected, pages (e.g. HTML) are displayed and can be browsed. At least one of the pages may show a category or a list of items being offered online by the server device identified by an address identifier (e.g. a Universal Resource Identifier or Locator). The user may be interested in exploring one of the items and hence selects thereon (e.g. via a pointing device to activate a link underneath) or enter a specification to specify an item. The client device then generates a request at **504**. In addition to a specification of the selected item, the request includes an IP address identifying the server device, the client device and/or the user.

At **506**, the client device or the user awaits a response from the server device to the request. As indicated in **Figure 4**, process **400** needs to look up for the selected item based on the specification. Once the item is located, specifically, the item with an associated 3D representation is located, a response to the request is returned from the server device. Depending on an exact implementation, the response may include the 3D representation and activates the interactive environment that may require a 3D

model from the user. At **508**, process **500** checks if a 3D model of an object to be tested with is available. When the 3D model the object is ready, the user can now test or try the selected item with the supplied object. If the 3D model is not readily available, process **500** will go to **509** to request for such 3D model.

Referring now to **Figure 5B**, there is shown a process flowchart **530** of providing the 3D model of the object according to one embodiment of the present invention. Process **530** shall be understood in conjunction with the setting in **Figure 3A** or **3B**. At **532**, process **530** examines if an imaging system is ready, namely if it is calibrated or aimed at the object to be modeled. At **534**, the imaging system takes one or more images of the object. Depending on the setting or the 3D modeling application in use, the imaging system may take two images (e.g. for stereo imaging) or a sequence of images surrounding the object. The 3D modeling application is then executed on the images at **536** to generate a 3D model of the object at **538**. According to one embodiment, the 3D model is presented in Cult3D object format and can be viewed by Cult3D viewer. According to another embodiment, the 3D model is presented in a format supported by pulse3D viewer provided at www.pulse3D.com.

Referring now back to **Figure 5A**, after it is determined that the 3D model is available, an interactive platform including both of the 3D representation and the 3D model is displayed on a display

screen of the client device at **510**. The interactive platform permits the user to get the item onto the object, adjust spatially in a 3D space the 3D representation or the 3D model with respect to each other, respectively at **512**. In one embodiment, the 3D representation of the item is adjusted left/right, up/down and back/forth till the user feels an appropriate fitting is reached. Further the interactive platform permits the user to view or browse the jointed presentation of the 3D representation and the 3D model from any perspective the user prefers.

At **514**, process **500** determines if the user is satisfied with the selected item. If the user does not like the selected item or wants to have another selection, process **500** goes to **504**. If the user is satisfied with the selected item, process **500** goes to **516** that may enter a transaction between the user and the business hosting the web site.

According to one embodiment of the present invention, **Figures 6A-6E** illustrates a sequence of interactive environments or displays that may be displayed on the display screen of a client device. In **Figure 6A**, an interactive platform **600** displayed as a web page includes a list of 3 glasses that are respectively presented by pictures or 3D representations thereof **602**, **604** and **606**. Web page **600** further includes a selection area **608** and a manipulation table **610** in addition to an interactive representation area (i.e. interactive environment) **612**. Optionally, web page **600**

indicates a connection status **613** of the client device with a server device hosted, presumably, by an eyewear business.

It is assumed that at least one or each of the three initially displayed glasses has an associated 3D representation. A testing object for the glasses is evidently a human face. A 3D model of an object (i.e. a human face) **614** has been provided for testing a selected pair of glasses. As described above, 3D face model **614** may be generated on demand using the method of **Figure 3B** or pre-generated or transferred from another device/memory.

Interactive platform **600** permits an import of 3D face model **614** into interactive representation area **612** as such the user is now able to try on a selected pair of glasses.

Generally, it is not easy to put a selected glasses right onto 3D face model **614** initially through a pointing device (e.g. a mouse) depending on the exact orientation of the 3D face model. As one of the features of the present invention, a default position of the selected glasses is provided with respect to the 3D face model. The default position may be assigned initially to two possible positions, one being "ON" position and the other being "OFF" position.

According to one embodiment, an "ON" position, when selected, causes the selected glasses to be on the 3D face model in accordance with predetermined characteristics of the 3D face model. An "OFF" position, when selected, causes the selected glasses to be placed before but off the 3D face model in

accordance with the predetermined characteristics of the 3D face model.

According to the embodiment, the characteristics of the 3D face model include 3D positions of the pupils and the nose tip of the 3D face model in a reference space or frame. Additionally a nose profile may be derived with reference to the nose tip to facilitate the try-on process. Referring now to **Figure 7**, there is shown an illustration of determining the characteristics of the 3D face model **700**. A 3D reference space or frame **702** is used to accommodate 3D face model **700**. Nose tip **704** is determined from a most extended point of face model **700** and expressed as (x_{nt}, y_{nt}, z_{nt}) . Using nose tip **704** as a starting point, an upward and left/right search in a localized window **710** can be conducted. A verification via color and/or texture of the pupils in the face model, e.g. in HIS color coordinates, can determine coordinates of the two pupils (e.g. black holes), expressed as (x_{le}, y_{le}, z_{le}) **706** and (x_{re}, y_{re}, z_{re}) **708**. The coordinates are useful for scaling and/or orienting the 3D representation of the glasses so that the glasses can be graphically made fit to the 3D face. With the coordinates, the nose profile, especially around the area that holds the glasses, can be determined as well from the face model **700**.

Referring now to **Figure 6B**, there is shown that one of the glasses is chosen, a 3D representation **620** of the glasses is initially positioned at a default position (i.e. "OFF" position) before the 3D

model (i.e. the face model). The default position in this case is to position the selected glass before but off the face model. The default position also includes a pre-fixed distance D (not shown in the figure) the glasses shall be initially positioned away from the face model. To ensure that the glasses and the face model coincide, for example, the orientations and/or sizes correspond, the characteristics of the face model is used to initially position and/or scale the 3D representation of the glasses.

An “on” button **624** is not necessary but is desirable to automate wearing of the glasses on the face according to a calculated or predetermined default “ON” position. **Figure 6C** shows that “on” button **624** is activated, which causes glasses **620** to move from “OFF” position to “ON” position. It should be noted that the “ON” position is a default position that is determined in accordance with the characteristics of the face model and may not be necessarily the way the user would wear the glasses.

Figure 6D shows that the user has “rotated” the face model with the glasses on to view from right side how he/she may look when the selected glasses are worn. The user may adjust the glasses up or down, left or right in accordance with a set of criteria that the user feels “right”. **Figure 6E** shows another perspective where the user views how he may look like with the selected glasses on and may perform additional spatial adjustment.

Figure 8 shows a process flowchart of the glasses fitting operations according to one embodiment of the present invention. The process **800** in **Figure 8** is generally implemented in a client computing device coupled to a data network, such as the Internet, and used by a user who may be a potential buyer of eyeglasses. In one preferable embodiment, the user activates a browsing application (e.g. Microsoft Internet Explore) and provides an IP address identifying an eyeglass business web site (e.g. www.eyeglasses.com). Once connected, the computing device is provided or downloaded from the web site an interactive platform at **802**. The interactive platform may correspond to the one **600** of **Figure 6A**. Depending on an exact implementation, the interactive platform may include a panel consisting of respective displays of glasses of different style. By virtue of the present invention, at least one of the displays is associated with a 3D representation of the glasses. In other words, there is a 3D model of the glasses that can be uploaded to the computing device for testing or trying on if the pair of glasses is selected.

At **804**, the platform requests an import of a 3D face model of a user who will preferably and ultimately buy and wear the glasses. The face model may be generated in real time, pre-generated or downloaded from another device/memory. Process **800** needs to ensure that an appropriate 3D face model is imported at **806**. Once the 3D face model is accepted, process **800** awaits a selection from the user among the displays of glasses of various

styles at **808**. After a selection is made, the characteristics of the face model are computed by an application that may be embedded in the platform or in the web site. In a preferred embodiment, the application is an applet or script application that computes the characteristics including a number of parameters (e.g. the coordinates of the nose tip and pupils) from the face model to facilitate the try-on process. It should be noted that the computation of the characteristics of the face model may happen anywhere before an actual try-one process starts.

At **812**, a 3D representation of the selected glasses is loaded into the platform from the network and places the glasses in front of but off the face model in accordance with the characteristics of the face model. In one implementation, the pair of glasses is initially placed a few inches away from the face but kept in parallel with the centers of the glasses lens coinciding with the pupils of the face model.

At **814**, the user has an option to wear on the glasses by perhaps clicking a designated "On" button. Internally, at **816** the platform allows the glasses to move forward onto the face model in accordance with the characteristics of the face model to ensure that the pair of glasses is indeed "on" the face (not hanging on the face). In another embodiment that is further illustrated below, the pair of glasses is put onto the face model based on a set of position parameters that may have obtained from a previously selected pair

of glasses. This feature will allow a newly selected pair of glasses to follow the positions a previously selected pair of glasses that has been adjusted. At **818**, a combined view of the face model with the glasses on is provided and allows the user to view the combined view from any chosen perspective that may include a top, side, or front view.

Figure 9 shows an interactive try-on platform **900** displayed by a popular browser. The exact display configurations may differ from one implementation to another. What is important is some of the features in the present invention being utilized in platform **900** to facilitate the try-on experiences by a user or a potential glasses wearer. Platform **900** shows that two display windows **902** and **904** are integrated therein. Each of the display windows allows the user to load up a 3D face model, select a pair of glasses, perform spatial adjustments of the selected glasses with respect to the face model as described above. One of the advantages for two display windows in a platform is to allow the user to compare visually two different pairs of glasses side by side when they are respectively worn by the user.

To assist the user to visually adjust the glasses on the face model, an adjustment panel **906** is provided. Panel **906** is an exemplary graphic user interface and includes a number of buttons that can be conveniently used by the user to adjust the glasses around the face model. For example, when "Right_in" is clicked or

activated, the right arm of the glasses goes inward. If it appears that the glasses too tight, "Right_out" or "left_out" could be clicked to release the tightness. Panel **906** also includes respective buttons to spatially move the glasses in a reference 3D space, along/around the x, y or z direction.

As one of the features in platform **900**, a graphic effect is provided to affect the opacity of the lens in the glasses so that the user can determine what is the most appropriate lens opacity for the selected glasses. It should be noted that the 3D representation of the glasses does not have to include various opacities for the lenses. Those skilled in the art understand that a selected opacity can be graphically painted by choosing appropriate colors, in particular, appropriate pixel values.

In addition, parameter control **910** is provided to get or extract the position (i.e. the coordinates) of the glasses after the user has adjusted the glasses with respect to the 3D face model. The position may include information how a pair of glasses is positioned on the face model. According to one embodiment, the information includes a plurality of coordinates of some of the corners of the glasses, for example, the end of the two arms, the center of the glasses (e.g. with respect to the nose tip). According to platform 900, when "Get P's" is clicked, the coordinate information is obtained and saved in a memory space. When a new pair of glasses is selected, rather than performing another trial-and-

error, the user can simply click "Set P's" to apply the collected coordinate information to the new pair of glasses. As a result, the new pair of glasses goes to the previously determined position.

5 The advantages of the invention are numerous. Different embodiments or implementations as a method, an apparatus or system may yield one or more of the following advantages. One of them is the interactive presentation mechanism desired by an online business to permit a user to try or test virtually a selected item for an object provided by the user. When the item is a
10 wearable product and the object is the user himself/herself, the user can perceive how he/she may look like with the wearable product on. Another advantage or benefit provided by the present invention is the marketing opportunity of certain type of goods or services that would otherwise be limited to localities. With the
15 present invention, these goods or services can be now offered online over the Internet so remote users can "feel" these goods or services.

The present invention has been described in sufficient detail with a certain degree of particularity. It is understood to those
20 skilled in the art that the present disclosure of embodiments has been made by way of examples only and that numerous changes in the arrangement and combination of parts as well as steps may be resorted without departing from the spirit and scope of the invention as claimed. Accordingly, the scope of the present invention is

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